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# Evolution in Wearable Technology: Smart Vest

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***Abstract*—Through this paper we would like to pitch light on the latest trend in embedded technology application that is smart clothing. This paper illustrates the idea how electronics industry will change the textile and fashion industry that is enabling users to do more on the go. Smart vest proposed here utilizes the enormous potential of internet of things its collects data from bio sensors and sends it through cloud for further processing. There are several ways to read the data here we have demonstrated how we can view data on cellular phone using via android application.**

***Keywords — Wi-Fi, IOT,MQTT,SSID***

## I. INTRODUCTION

We have all experienced how technology has changed its phase over time of three decades. The most noticeable we have seen in the electronics industry and communication sector, smart Phone is a good example of it. Another example of such evolution can be seen medical equipment field. This filed required high precision and reliable outcomes, machines such as electrocardiograms, blood pressure equipment, Magnetic Resonance Imaging (MRI) machines etc. they all have shrunken to the size of a room or table. In the mid 2000's we have seen rise of portable hand-held equipment such as a blood pressure monitor system etc. In 2013 google introduced glass explorers. Wearable devices are not limited to just personal uses Heads up display in pilot helmet is one of the examples of military applications. The smart vest proposed here uses Message Queuing Telemetry Transport (MQTT) protocol and NodeMCU controller to collect data from the sensors placed on the vest and send it to cloud storage from where we can we access the data through an android application.

## II. MOTIVATION

The aim of this project is to demonstrate the fact that low cost and efficient development of wearable devices are possible with minimum distortion in data. These systems might prove to be a game changer in the startup industry. Moreover, this system would also empower those who seek for cost effective medical care in rural and sub-urban area where medical facilities are not par with current facilities. If we look at the developing countries, we see how conditions could be for a person who needs immediate medical attention and assistance, people who live near elevated landscape. This device is an open source to enable further development into this technology which would enable people get in-depth knowledge about this technology which would result in similar platform system to perform different tasks such as geological survey or military applications such life sign monitoring etc. If we take an instance where we need to take EEG and temperature of a person who is stranded over a cliff and needs an immediate medical care. In this situation we cannot expect the first responders to carry bulky equipment on the site so in such life and death situation we could use the proposed smart vest to monitor person's bio parameters such as pulse, body temperature. If the person is equipped with it as a survival equipment he and the medical team would know his exact status which would help them to take a more accurate action and would also spare them from the dilemma of uncertainty. Conditions such as hypothermia can be diagnosed using this device, there are many more such applications in military filed as well, which would need appropriate attention.

## III. BLOCK DIAGRAM

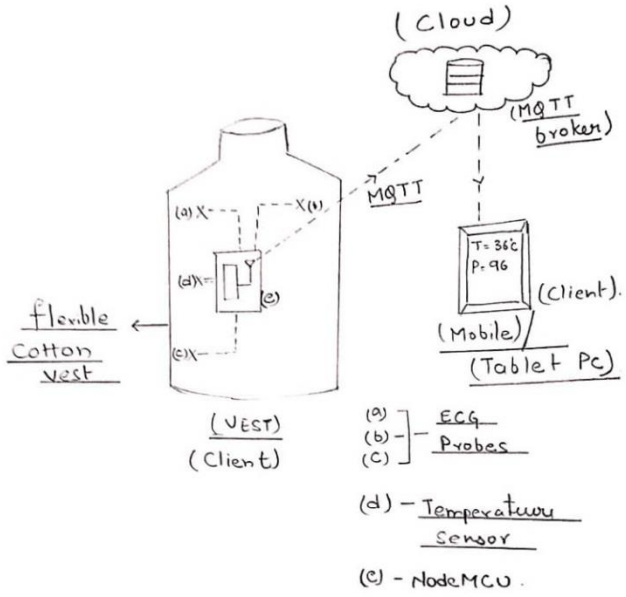


Figure 1.0 Block Diagram

Understanding the block diagram:

This is a simple block diagram to show the concept and fundamentals of a wearable device.

*a. NodeMCU*

NodeMCU is an ESP8266 wifi-soc based development board based on lua scripting and its one of the best development board used for medium sized IOT projects.

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Basically it's a single board microcontroller with 128 KB memory with storage capacity of 4 MB its main CPU is based on tensilica Xtensa LX106 core.

It has one analog input (D0) other than this it has 13 GPIO pins with multiplexed functions and it supports communication protocols such as UART, SPI and I2C etc. We can use Arduino IDE to write code for the NodeMCU ESP-12 board.

It comes with different power saving modes like light-sleep mode, modem-sleep mode, deep-sleep mode which is the best of the three mentioned above which takes about 10 uA current which saves battery life.

In this proposed device here uses the NodeMCU board to run the sensors and collect the data from them and send it to the MQTT broker via WiFi link.

It also process the data collected from the sensors and saves the data for a short amount of time.

It is powered up using Li-ion batteries of capacity 3.7V and 3800 mAh upon continuous usage the consumption is 140 mAh.

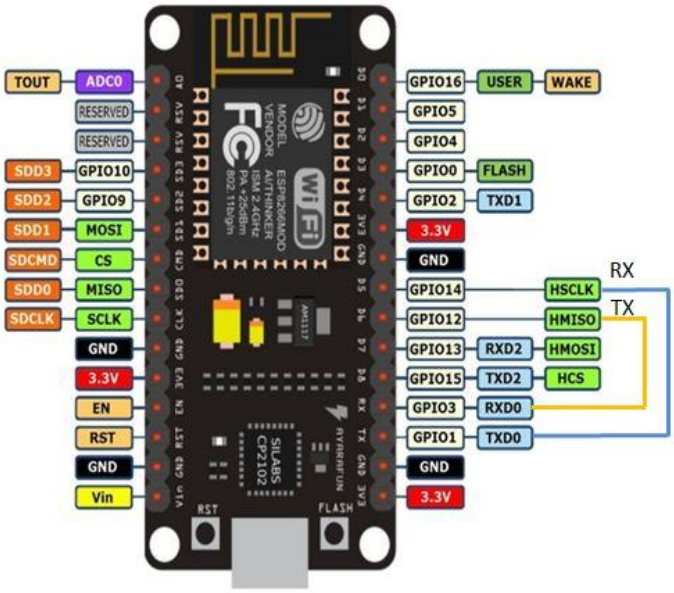


Figure 2. NodeMCU

*b. Sensors*

Sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A Sensor converts the physical parameter (for example: temperature, blood pressure, humidity, speed, etc.) into a signal which can be measured electrically. Now in this proposed system we have used DHT temperature sensor (DHT11) and AD8232 analog sensor used for ECG and pulse and measurement ECG. DHT 11 works on serial communication protocol while we take the reading from AD8232 to analog input of nodeMCU (D0) pin. They both require 3.3V input. It is to be noted that the nodeMCU houses three 3.3 volt outlets which are sufficient to power these sensors and run them over a prologue period of time. DHT11 is a digital temperature sensor which means we can assign any GPIO of microcontroller to its data pin. Least count of the DHT11 sensor is 0 to 50 degree with 2% accuracy.

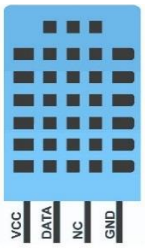


Figure 3.DHT11

*c. Wireless TX/RX*

Wireless communication is the backbone of this device. ESP8266 uses the Wi-Fi protocol suit 802.11b/g/n with ISM bandwidth of 2.4GHZ. The default clock speed of ESP8266 is 80 MHZ. To connect the board with the Wi-Fi we just need to provide SSID and password while coding as shown in the figure 4. We can transmit and receive data via this method as the battery life is consumed more in this process so it is advised to put the board in one of the sleep modes.

```
const char* ssid = "redmi";
const char* password =  "qwerty1234";
```

Figure 4. SSID and password command

*d. Power supply*

There are several ways to power up this device but suggested is to use Li-ion or alkaline batteries. Following is a simulation of the power supply source using multisim software.

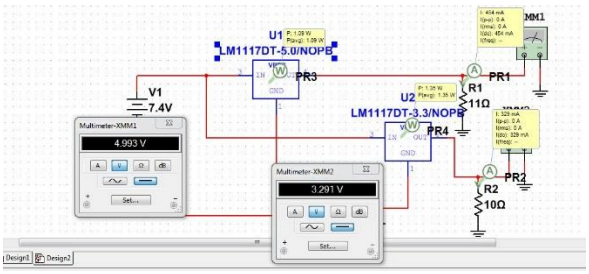


Figure 5. Supply simulation

LM1117 is used to regulate the input from the source to 5 and 3 volts respectively. Other regulator options such as LM317 which is programmable IC with internal thermal shutdown.

*e. Cloud*

One of the tasks to send data from the nodemcu to a storage unit for further processing but the question is where and how? One of the most efficient ways to do it is by using MQTT protocol suit. MQTT is an ISO standard 20922, publish-subscribe based messaging tool. It is a lightweight m2m tool.

*f.Data viewing*

There are several ways we can view our data for example we can use the web-sockets in the broker or on a smart phone for this purpose. There are several ways of doing it one of the best ways is to use Basic4Android tool chain

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used for rapid application development. You need to keep in mind the usage and UI of the application according to your needs.

## IV. EVOLUTION AND SCOPE

Electronics industry changed rapidly year after year with implementation of sophisticated development techniques. According to a report by Transparency market research, the healthcare and medical segment held the largest revenue share and accounted for about 35.1% of the entire wearable technology market in 2012. The report cites that major reasons for this include the rise in aging population and an increase in people with diabetes. Fitness and wellness were the second major sector with a surge in activity trackers.

This was closely followed by the infotainment segment. However, by 2018, the Infotainment segment is expected to surpass the fitness and wellness segment driven by robust growth of smart watches and smart glasses. The market is yet to take off in India both in terms of companies manufacturing wearable smart devices and customers willing to use them.

It will be correct to say now that wearables are indeed the future and will be the next chain of evolution after emergence of smart phones. This will steer current businesses towards a new era of possibilities. Artificial intelligence will only be acting as a catalyst to this whole evolution cycle and this will directly affect lives of people. The major sector of dominance will be fitness, healthcare and possibly military.

1. *Fitness*

   Smart bands and wrist watches being able to record daily activates such number of laps with different sensors embedded into it will be able to measure various parameters.

2. *Healthcare*

   Measuring various vital parameters such as ECG etc. and being able to send and receive that data during emergencies

3. *Military*

   It will all depend on the requirement of mission and assignments this will lighten the heavy load on soldiers and we be able to provide better performance than bulky equipment which lack mobility.

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